

Detector Pool's Pilatus User Guide

Logistics & basics....

1. Computer & Power must live in the hutch.
2. Turn on Computer & log in using the local keyboard/monitor.
3. Turn on the Pilatus Power Supply, preferably after you have mounted the detector!!!!
4. Shutdown: In the reverse order.

How to log into Pilatus DAQ Computer, remotely?

- Please open all the control windows from outside the hutch.
- Connect the Pilatus Computer via Unix or X-server software on PC (e.g., cygwin or EXCEED).

`ssh -Y det@164.54.107.190` (at Sector 7... IP might vary.. 164.54.107.19?)

[Pilatus2]

Notes:

1. You might not need the -Y depending on your version of UNIX. It is sometimes needed to get X-Windows forwarding to work properly.
2. You can get the IP address by logging into the computer from the Console and open an xterm. The IP should be listed in the prompt. If not, then you did not get on the network.

Pilatus software:

From the home directory (/home/det/):

start_camonly

This starts one window: camserver

Keep the camserver window around, since it will tell you if the system is having problems.

EPICS (talks to camserver)

From Pilatus DAQ computer (e.g., det@164.54.107.199), type:

start_epics

[NB: You should be in the /home/det directory. This will start epics ioc console, MEDM screen and also a real-time viewer (/home/det/python/loop_focus_mode.py)]

Image Viewer (Nino's)

From the home directory (/home/det):

start_viewer

Thresholds:

Lower level thresholds are currently set via EPICS. The threshold should be set **to 2keV below the working beam energy.**

pilatusROI.adl

Pilatus Detector GSE-PILATUS2:

Camserver

To camserver:

From camserver:

File

Path:

Base filename:

Next file number:

Filename format:

Full filename:

Auto increment:

Detector

Threshold (eV):

Shaping time/Gain:

Data corrections

Bad pixel file:

Bad pixels:

Flat field file:

Flat field valid: Min. flat field:

ROIs/Images

ROI definitions: Min. array update:

Clear ROIs: Highlight ROIs:

Post images: Min. image update:

Collection

Acquire mode: Exposure period:

Exposure time:

Number of images: Exposures/image:

Read TIFF timeout:

Status:

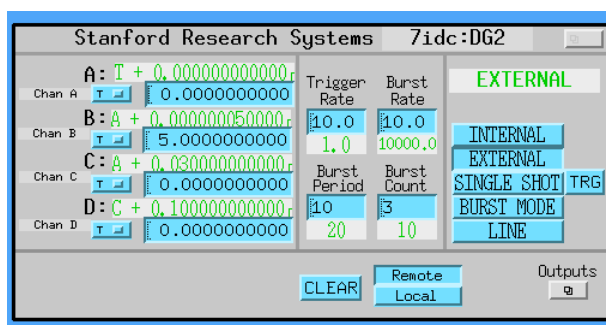
Done

Pilatus MEDM screen

<http://cars9.uchicago.edu/software/epics/pilatusROIDoc.html>

Aquisition Modes

- 1. Internal** — This is the software triggered mode. Just specify *Exposure Time* and hit acquire. You can also specify *Number of Images*. Ignore *Exposure Period* and *Exposures/image* parameters.
- 2. External Trigger** — If you want to synchronize your exposure sequence with an external event (e.g., some sample reaction), use this mode. You specify *Number of Images*, *Exposure time*, and *Exposure Period*. The *Exposure Period* must be greater than *Exposure Time* plus 4 milliseconds to allow for readout. You arm the detector by hitting the acquire button. The Pilatus will wait until it see a TTL rising edge on its external input LEMO. It is best to use a base filename which does not end in an underscore. It will produce individual files that are indexed properly. For example, use a base filename, like: image It is best to save data to the local disk in this mode. (Typical Application: time-resolved SAXS)
- 3. External Enable** — This is for gating the detector (e.g., on a single-bunch for pump-probe studies such as at 7-id and 20-id). You specify Exposure/image (e.g., 65000) and it will gate for this many times (LEMO Input: Extern In). This feature essentially does on-chip summing. Things to note: If using the SRS SDG 535, use TTL Normal High Z. T is usually P0 or laser signal. $A = T + \text{delay}$ and $B = A + 30\text{ns}$.



- 4. Alignment** — Takes images over and over again and saves to the same file. It overwrites to the same file. This is useful for alignment!

Nino's Psuedo-Real-time Image Viewer

This displays the last image that was taken. It requires the EPICS IOC to be running.

In order to start, from the Pilatus DAQ computer (det@164.54.107.199), type:
`start_viewer`

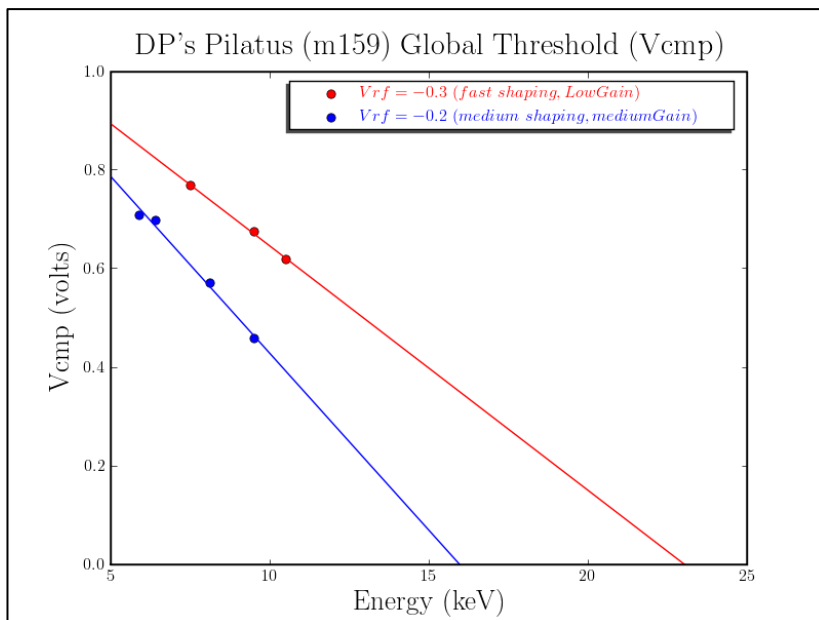
In order to stop this, you need to hit Control-C

Image Viewer (ImageJ)

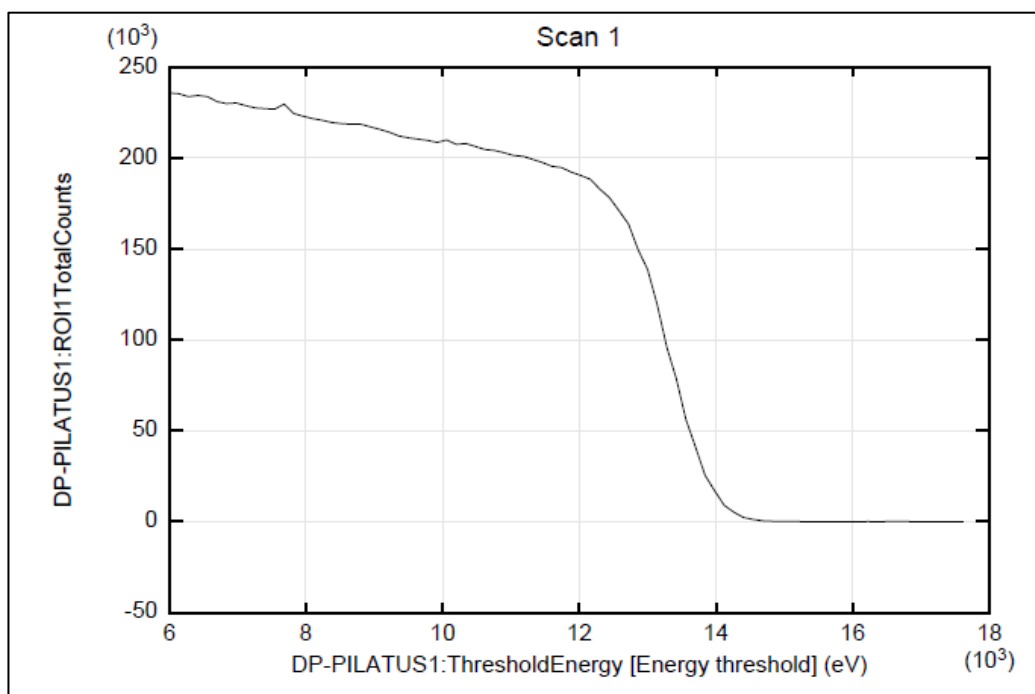
Installed on the Pilatus DAQ computer is an image display package called ImageJ. Simply type: `imagej` from an xterm on the Pilatus DAQ computer and it will load ImageJ. It is fairly easy to use... (File → Open → etc.) To change the gray scale contrast, type: `Ctrl-Shift-c`; To get a line profile, draw a line with the toolbar, then type `Ctrl-k`. To get statistics on the full image or a box, type: `Ctrl-m`. For more help go to <http://rsbweb.nih.gov/ij/>

Threshold

Lower level thresholds are currently set via EPICS *The threshold should be set to 2 keV below the working beam energy*. Vcmp is the global threshold. There is also a pixel-by-pixel thresholds (*trimbits*) which are also adjusted to compensate for voltage drops across the sensor. However, this is transparent to the user. To give you an idea of the conversion between Vcmp and x-ray energy, see the plot below.



Below is a scan of the energy threshold while the beam energy is at 13.5keV and we are using the fast shaping time ($V_{rf} = -0.3$). This gives you can idea of the energy resolution. Note that increasing counts with decreasing energy is caused by inter-pixel charge sharing (i.e., split events).



Data Format

Images are saved as TIFF files. They are stored as 32-bit unsigned integers, little-endian. Each Pilatus pixel can count to 20-bits and will rollover if it goes beyond that.

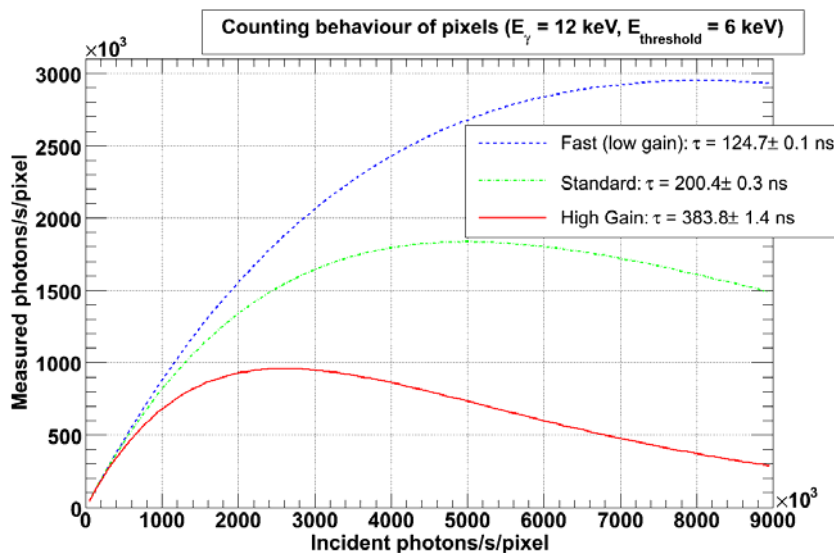
* Troubleshooting *

1.) If you see DMA or DCB errors in the CAMSERVER window, it is best to re-initialize the detector. Do the following:

- In the CAMSERVER window. type: **dcb**
- Close the EPICS IOC and MEDM screens.
- Now, restart the EPICS server and MEDM windows.

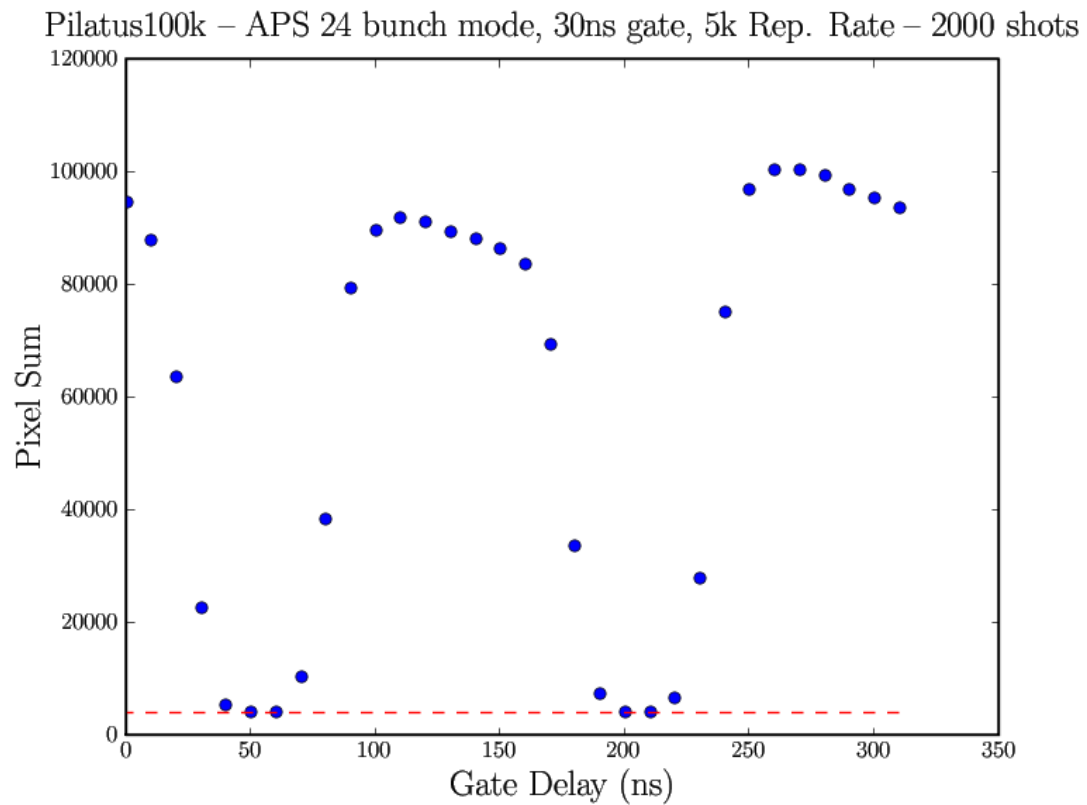
Things to consider when using the Pilatus Detector

- The Pilatus is a counting detector. A deadtime correction is automatically applied, but it is best to limit the count rate to be less than 500kHz for the fast shaping time.

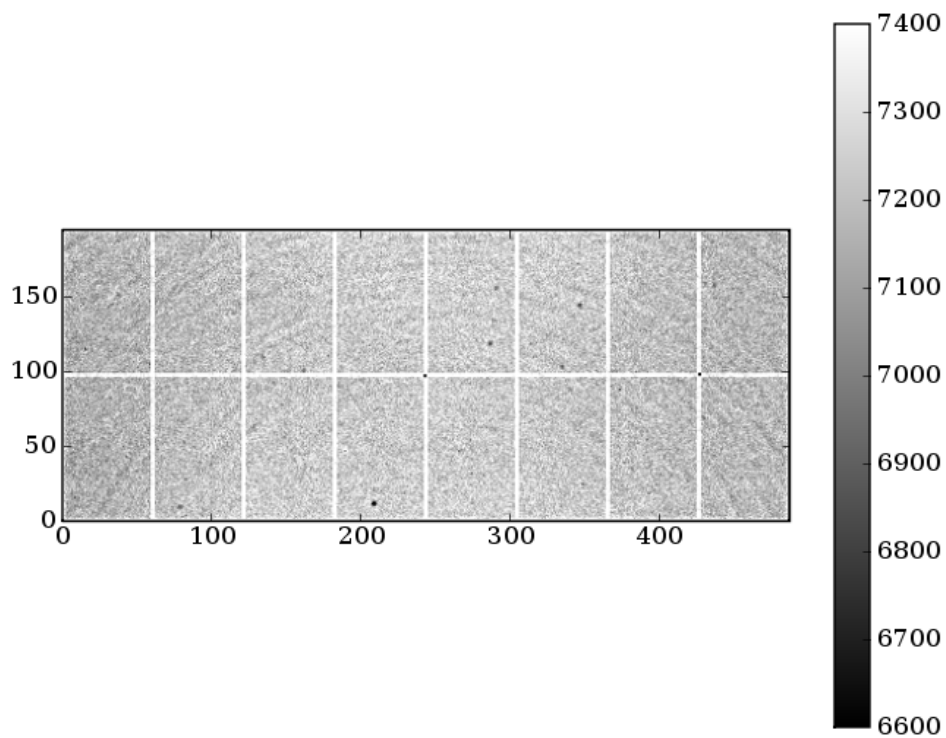


- In **external enable mode**, the detector will timeout after 16 seconds if it does not receive any gate pulse. If this happens, you will get DCB/DMA errors in the CAMSERVER. You must re-initialize the Pilatus. See the troubleshooting section.
- **Detector Protection**
 - ➔ No direct beam or strong Bragg spots
- **Calibration**
 - ➔ Flat-field and bad pixel masking should be performed off-line.

Example of 24-bunch mode gating (Landahl and Miceli)



Example of a Flatfield Image



Bad Pixels Regions (As of Nov 2008)

Note: Bad Pixel Mask only applied to EPICS ROIs, but not raw Pilatus TIFF files!!!!

Region # 1

11 <= x <= 13
50 <= y <= 52

Region # 2

188 <= x <= 190
147 <= y <= 149

Region # 3

241 <= x <= 244
96 <= y <= 99

Region # 4

372 <= x <= 374
106 <= y <= 108

Region # 5

425 <= x <= 428
95 <= y <= 98